

SUBSTATION MAINTENANCE PROCEDURE

**TITLE: INSULATING OIL & MEDIA
SF6 HANDLING PROCEDURES TO MINIMIZE LOSS**

P S 16-SF6-08

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INDEX KEY WORDS: SULFUR-HEXAFLUORIDE (SF6), ENVIRONMENT.

REFERENCE DOCUMENTS: P S 16-P&L-01, P S 16-CRYO-01.

I. BACKGROUND

SF₆ gas is a green-house gas, SF₆ gas does not contribute to stratospheric ozone destruction, and although the released SF₆ gas accumulates in the atmosphere over long periods of time due to its long atmospheric life, its atmospheric concentration will stay below 10 parts per trillion by volume in the long term future. However, the life of an SF₆ gas molecule in the atmosphere is estimated to be over 3000 years.

Maintenance and Construction electricians shall use SF₆ gas handling procedures that minimize SF₆ gas release into the atmosphere.

II. POLICY

The following is policies regarding the use of SF₆ gas to minimize SF₆ gas release into the atmosphere:

- A. Report the amount of SF₆ in pounds required to refill all leaky equipment annually. Using a weight scale is recommended to determine the amount of SF₆ released by the equipment.
- B. All SF₆ handlers are required to take the "SF₆ Gas Handling" course or be trained by someone that has taken this course.
- C. Used SF₆ gas shall be recycled.
- D. All new SF₆ gas applications shall allow recycling.
- E. SF₆ gas losses from electrical equipment are to be reduced by: 1) improved equipment design, 2) timely intervention by electricians to repair gas leaks, and 3) by developing improved gas handling techniques.
- F. Purchasing of new equipment and procedures which do not allow for SF₆ gas recycling is to be discontinued and replaced by a suitable alternative.
- G. At the end of every calendar year, our Utility will accumulate the SF6 emissions records from all leaking equipment. Data will be collected from each district foreman's entry in the trouble report of Maintenance Application Program (MAP) or other special means and will be submitted to the EPA.

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III. PROCEDURES

Our Utility shall use the following SF₆ gas handling procedures to prevent gas release into the atmosphere.

A. Atmospheric Safeguards:

1. **Do not** release SF₆ gas into the atmosphere.

NOTE: The only exception to this is the minor amount of SF₆ lost while measuring the gas for moisture content or taking of gas samples.

2. SF₆ gas must be removed from equipment and stored in SF₆ gas carts prior to internal maintenance or equipment salvaging. The removed gas is to be reconditioned and reused whenever possible.
3. Faulted SF₆ gas in power equipment **must not** be dumped to the atmosphere. Faulted SF₆ gas may be toxic and must be passed through an external scrubber filter unit to remove impurities before pumping the gas into the cart for storage.
4. Power equipment such as SF₆ filled instrument transformers which are removed from service but are scheduled either for return to the warehouse or to be reenergized, may not require all the SF₆ gas to be removed prior to movement or transportation. Whether the SF₆ gas is removed or gas pressure reduced, depends upon the equipment manufacturer's recommendations.

B. SF₆ Gas Handling Procedures: Proper SF₆ gas handling procedures must be followed to eliminate SF₆ gas release to the atmosphere.

1. Pull a vacuum on interconnecting hoses prior to passing SF₆ gas through the hoses. This eliminates contamination of the SF₆ gas with air.
2. Never purge or bleed SF₆ gas through interconnecting hoses as a way of cleaning the hoses. This vents SF₆ gas to the atmosphere, and also may contaminate the SF₆ gas with air remaining in the hoses.
3. When removing SF₆ gas from power equipment, pull a long hard vacuum (goal, 50 microns) to remove the maximum amount of SF₆ gas; any gas left in the equipment, will end up in the atmosphere.
4. When filling equipment with SF₆ gas, first pull a hard vacuum (goal, 50 microns or below) to remove as much air and moisture as possible. Any air left in the equipment will contaminate the SF₆ gas on filling.

C. SF₆ Gas Filling Carts: A special SF₆ gas filling cart was designed and fabricated by the Utility General Shops. This cart pulls a vacuum on all hoses prior to filling the power equipment directly from the SF₆ gas cylinders. The filling cart is built on a hand truck which

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can carry one to two SF₆ gas cylinders, and has a small 10 cfm vacuum pump which is permanently mounted to it. The filling cart also has a SF₆ gas pressure vacuum/gauge, and control valves.

- D. Power Equipment Salvaging, Removal and Reclamation of SF₆ Gas: Some older SF₆ gas carts, retired from maintenance districts, have been dedicated for use as SF₆ gas reclamation systems for equipment being salvaged. There are presently two of these carts in the system. These carts are equipped with external scrubber filter units to reclaim the SF₆ gas before it enters the storage tank on the cart.
- E. Air Removal from SF₆ Gas: When SF₆ is known to have been contaminated by air, the following SF₆ gas handling procedures are to be used. When the contaminated SF₆ gas is removed from equipment, the SF₆ gas is liquified in the gas cart's storage tank, but the air is not liquified, and eventually impedes further removal of the SF₆ gas from the equipment. Present procedures to handle this problem when it occurs are described in P S 16-P&L-01, "Pall & Limco SF₆ Gas Carts Operating Procedures," page 17, and P S 16-CRYO-01, "Cryoquip Gas Cart Operating Procedure," page 14. In summary, the procedure is to bleed the contaminants from the top of the storage tank. Liquid SF₆ gas is in the bottom of the tank. The atmosphere on top of the tank is a mixture of the air contaminants and SF₆ gas. The procedure is to slowly open a sampling valve on top of the tank for 1 to 3 minutes venting the gas mixture to atmosphere. The valve is then closed for half an hour, allowing the SF₆ gas within the tank to reliquify. The procedure is then repeated until the pressure on top of the tank is proper for the tank's temperature.

This procedure is effective however, during the process, some SF₆ gas is vented to the atmosphere. One alternative is to purchase a SF₆/nitrogen separation and filtration plant, but the cost of this alternative is prohibitive. The best solution is to minimize the amount of air contamination by always following approved SF₆ handling procedures.